

REMARKS

Amendment summary

Upon entry of this Amendment, claims 45-49, 53-63, and 67-72 will be pending.

Claims 45-47 and 59-61 are amended to incorporate the subject matter of claims 50-52 and 64-66, respectively. Claims 50-52 and 64-66 are accordingly canceled.

No new matter is added by this Amendment, and Applicant respectfully submits that entry of this Amendment is proper.

Response to rejection of claims 45-72 under 35 U.S.C. § 103 based on Aikawa

Applicant respectfully submits that the presently claimed invention is not anticipated by or rendered obvious by Aikawa because (1) Aikawa does not disclose or suggest that the presently recited fine fibers are distinct from the presently recited high-modulus fibers; (2) Aikawa does not disclose or teach a battery separator in which the average fiber diameter of the high-modulus fibers is 5 times or more an average fiber diameter of the fine fibers; and (3) the presently claimed invention exhibits unexpectedly superior properties, such as electrolyte-holding capacity.

In the Office Action, claims 45-72 were rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Aikawa (JP 2000-160432).

As amended, the present claims recite that the average fiber diameter of the high-modulus fibers is 5 times or more an average fiber diameter of the fine fibers. Accordingly, the present claims recite that the high-modulus fibers are distinct from the fine fibers.

Applicant respectfully submits that Aikawa does not anticipate or render obvious the presently claimed invention because it does not disclose high-modulus fibers that are distinct from fine fibers. The Office Action sets forth the position that Aikawa discloses fine fibers and high-modulus fibers "in a single fiber" (see the second paragraph on page 3 of the Office Action). However, Applicant respectfully notes that the present claims recite that the high-modulus fibers are distinct from the fine fibers because the average fiber diameter of the high-modulus fibers is 5 times or more an average fiber diameter of the fine fibers. Accordingly, Applicant respectfully submits that Aikawa does not anticipate or render obvious the presently claimed invention, in which the fine fibers are distinct from the high-modulus fibers.

Applicant also respectfully submits that Aikawa does not disclose or teach a battery separator in which the average fiber diameter of the high-modulus fibers is 5 times or more an average fiber diameter of the fine fibers. The Office Action sets forth the position that the adhesive fiber of Example 4 corresponds to the presently recited high-modulus fiber (see the third paragraph on page 6 of the Office Action). Because Aikawa discloses that the adhesive fiber has a diameter of 11.8 microns, versus a fine fiber diameter of 1.2 microns, the Office Action sets forth the position that this aspect of the claims is rendered obvious. Applicant respectfully disagrees.

Applicant respectfully submits that the sheath-core composite fiber disclosed in Example 4 of Aikawa does not correspond to the presently recited high-modulus fiber. Example 4 in Aikawa discloses a battery separator comprising polypropylene-high density polyethylene mixed fine fibers (diameter = 1.2 μm) and sheath-core composite fibers (diameter of 11.8 μm) having a core component of polypropylene (melting point = 158°C) and a sheath component of high

density polyethylene (melting point = 131°C). As taught within Aikawa, “high melting point polypropylene,” which has a melting point of 166°C or more and constitutes the fiber of the invention disclosed in Aikawa, has a crystallinity higher than that of common polypropylene, which has a melting point of about 160°C. Accordingly, Applicant respectfully submits that the sheath-core composite fiber described in Example 4 of Aikawa does not correspond to the presently recited high-modulus fiber because the “high melting point polypropylene” defined in Aikawa has a melting point of 166°C or more, whereas the polypropylene used in Example 4 has a melting point of 158°C.

In addition, Applicant respectfully submits that the presently claimed invention exhibits unexpectedly superior properties. As described on page 16, lines 9-23 of the present specification, the present invention possesses unexpectedly superior electrolyte-holding properties. The passage is repeated here for the Examiner’s convenience:

When the nonwoven fabric used for the battery separator of the present invention contains the fine fibers and the high-modulus fibers, the average fiber diameter of the high-modulus fibers is preferably 5 times or more, more preferably 6 times or more, most preferably 6.5 times or more, the average fiber diameter of the fine fibers. The nonwoven fabric containing the fine fibers and the high-modulus fibers is liable to have a structure such that the thick high-modulus fibers form a skeleton and the fine fibers are located between the skeleton. If the diameter of the high-modulus fibers is 5 times or more the diameter of the fine fibers, the nonwoven fabric may effectively maintain spaces therein due to the high elasticity of the high-modulus fibers, a void rate under pressure is enhanced, and thus the electrolyte-holding capacity is also enhanced.

The unexpected results of the present invention are further reported by Mr. Masano Tanaka (one of the named inventors) in the attached Declaration Under 37 C.F.R. § 1.132, which illustrates that the present invention exhibits unexpectedly superior electrolyte holding capacity.

In the Declaration, Mr. Tanaka reports the results of two separators (Separators A and B) according to the present invention. Separators A and B have fiber diameter ratios above 5 (6.75 and 5.5, respectively), as recited in the present claims. Conversely, Separators C and D have fiber diameter ratios below 5 (4.8 and 3.9, respectively), and thus do not correspond to the presently claimed invention.

Separators A and B possess unexpectedly superior electrolyte holding capacities, as compared to Separators C and D. Specifically, both Separators A and B possess a 10.9% holding capacity of electrolyte under pressure, as reported in Table 1 of the Declaration. On the other hand, Separators C and D, which do not correspond to the presently claimed invention, possess holding capacities of only 8.5% and 8.0%, respectively. Accordingly, the Separators A and B possess unexpectedly superior electrolyte holding capacities when compared to Separators C and D.

In view of the above, Applicant respectfully submits that the presently claimed invention is not anticipated by or rendered obvious by Aikawa at least because (1) Aikawa does not disclose or suggest that the presently recited fine fibers are distinct from the presently recited high-modulus fibers; (2) Aikawa does not disclose or teach a battery separator in which the average fiber diameter of the high-modulus fibers is 5 times or more an average fiber diameter of the fine fibers; and (3) the presently claimed invention exhibits unexpectedly superior properties, such as electrolyte-holding capacity.

Applicant therefore respectfully requests the reconsideration and withdrawal of this § 103 rejection.

Conclusion

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

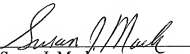
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Registration No. 30,951

Date: October 31, 2007

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of
Toshiaki Takase et al.
Appln. No.: 09/924,546 Group Art Unit: 1771
Filed: August 9, 2001
For: Battery separator

DECLARATION UNDER 37 C.F.R. 1.132

Honorable Commissioner of Patents and Trademarks
Washington, D.C. 20231

Sir:

I, Masanao TANAKA, citizen of Japan, residing at c/o
Japan Vilene Company Ltd., 7, kitatone, Koga-shi, Ibaraki
306-0213, Japan, do sincerely and solemnly declare:

THAT I am by profession a chemist having earned a
Master degree in analytical chemistry from Faculty of
Science and Engineering, Department of Industrial Chemistry,
Nihon University in March, 1987;

THAT since January, 1989, I have been an employee of
Japan Vilene Company Ltd., and since April, 1991, I have
been engaged in research activities relating to an alkaline
battery separator;

THAT I am an inventor of the invention of the above-
identified U.S. Patent Application (referred to as "the
present invention" hereinbelow) and therefore, am
completely familiar with the present invention;

THAT I have reviewed and understand the Office Action of June 1, 2007, and JP 2000-160432 (referred to as "the Aikawa Reference" hereinbelow); and

THAT in order to show the patentability of the present invention over the Aikawa Reference, the following experiment was carried out under my direction and supervision.

EXPERIMENT

(1) Preparation of separators

(1-i) Separator A

The procedure described in Example 1 of the specification of U.S. Patent Application No. 09/924,546 (referred to as "the present specification" hereinbelow) was repeated to prepare a separator of the present invention (referred to as "separator A" hereinbelow).

In this procedure, fibers (Young's modulus = 90 cN/dtex, fineness = 1.3 dtex, average fiber diameter = 13.5 μm , fiber length = 10 mm, density = 0.91 g/cm³, non-fibrillated, drawn) of high-crystalline polypropylene were used as the high-modulus fibers, and polypropylene fine fibers (average fiber diameter = 2 μm , $\rho/d = 0.083$, melting point = 172°C, fiber length = 2 mm, density = 0.91 g/cm³, sectional shape = circle) were used as the fine fibers.

(1-ii) Separator B

The procedure described in Example 1 of the present specification was repeated, except that fibers (Young's modulus = 90 cN/dtex, fineness = 0.86 dtex, average fiber diameter = 11 μm , fiber length = 10 mm, density = 0.91 g/cm³, non-fibrillated, drawn) of high-crystalline

polypropylene were used as the high-modulus fibers, to prepare a separator of the present invention (referred to as "separator B" hereinbelow).

(1-iii) Comparative separator C

The procedure described in Example 1 of the present specification was repeated, except that fibers (Young's modulus = 90 cN/dtex, fineness = 0.66 dtex, average fiber diameter = 9.6 μm , fiber length = 10 mm, density = 0.91 g/cm³, non-fibrillated, drawn) of high-crystalline polypropylene were used as the high-modulus fibers, to prepare a separator for comparison (referred to as "separator C" hereinbelow).

(1-iv) Comparative separator D

The procedure described in Example 1 of the present specification was repeated, except that fibers (Young's modulus = 90 cN/dtex, fineness = 0.43 dtex, average fiber diameter = 7.8 μm , fiber length = 10 mm, density = 0.91 g/cm³, non-fibrillated, drawn) of high-crystalline polypropylene were used as the high-modulus fibers, to prepare a separator for comparison (referred to as "separator D" hereinbelow).

(2) Evaluation

The uniformity index and the holding capacity of liquid under pressure of separators A to D were measured, in accordance with the procedures described in "Evaluation of Properties" of the present specification.

The results are shown in Table 1.

Table 1

Separator	A	B	C	D
Surface density (g/m ²)	40	40	40	40
Thickness (mm)	0.1	0.1	0.1	0.1
Fiber diameter ratio (*1)	6.75	5.5	4.8	3.9
Uniformity index	0.08	0.08	0.12	0.15
Holding capacity of liquid under pressure (%)	10.9	10.9	8.5	8.0

[*1: (fiber diameter ratio) = (average fiber diameter of high-modulus fiber)/(average fiber diameter of fine fiber)]

RESULTS

Separator A (fiber diameter ratio = 6.75) and Separator B (fiber diameter ratio = 5.5) of the present invention exhibited an excellent holding capacity of liquid under pressure, in comparison with Separator C (fiber diameter ratio = 4.8) and Separator D (fiber diameter ratio = 3.9) for comparison. This result shows that a separator in which an average fiber diameter of the high-modulus fibers is 5 times or more an average fiber diameter of the fine fibers has an excellent electrolyte-holding capacity.

I, the undersigned declarant, declare further that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further, that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001, or Title 18, of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Singed this 15th day of October, 2007.

Masanao Tanaka
Masanao TANAKA